



Les  
Producteurs  
de lait  
du Québec

# TRAINING COURSE



**SUSTAINABLE  
AND  
PROFITABLE**

**From Field to Barn**



# Key Points to Remember

## From the “Sustainable and Profitable, from Field to Barn” Training Course



### Yield Training

- Forage plant yields have not increased in 15 years and are on average 6 tonnes of dry matter (DM) per hectare.<sup>1</sup>
- In the best conditions, yields may reach 9.4 to 11.5 t DM/ha for mostly legume-base feed mixtures and 7.1 to 10.1 t DM/ha for mostly grass-based feed mixtures.<sup>1</sup>
- Mastering the basics, such as proper soil drainage, compaction prevention, liming to correct and maintain soil pH, better soil fertility and fertilization, is essential to make sure that the yield is good.

### Good Management Practices

Certain management practices can help improve perennial forage yields:

- Use quality seeding methods, including a firm seedbed, roll before and after seeding, seed at the proper depth, and use the right equipment for the types of seeds.<sup>2</sup>
- Use a companion crop to encourage establishment.<sup>2</sup>
- Use farm fertilizer carefully to minimize the risks of compaction and damage to plants:
  - ✓ Prioritize alfalfa fields that are 2 or more years old and grass fields.<sup>3,4</sup>
  - ✓ Spread rapidly (within 24 to 48 hours).<sup>4</sup>
  - ✓ Avoid spreading manure in wet soil conditions, such as in the spring, and spread moderate doses to reduce the weight of the tank.<sup>5</sup>
- Evaluate the composition of mixtures so that you can adjust nitrogen fertilization as the percentage of grasses rises (vs legumes).
- Perform cuts early at the beginning of the season and later at the end of the season to reach a compromise between yield, persistence, and quality in forage plants.
- Cutting at a height of 10 cm (4 in) or higher improves the quality of the forage and the persistence of the fields without affecting the long-term yield.<sup>2</sup>
- Making an informed decision about the fall cut can minimize the mortality risks, particularly for alfalfa<sup>6</sup>:
  - ✓ Ideally, avoid cuts in the fall (intervals of less than 30 days before the first killing frost).
  - ✓ If a fall cut is necessary to meet the herd’s needs or the plants have grown considerably (more than 30 cm/12 in. high), make sure that you have accumulated 500 degree days (base temperature of 5°C) since the previous cut.
  - ✓ If you have not accumulated 500 degree days, perform the cut soon after the first killing frost to prevent regrowth and the use of root reserves.
  - ✓ In all cases, if the fall cut is necessary, raise the height of the cut to 15 cm (6 in) ideally.
- Allowing snow to accumulate on the ground, either through vegetation or windbreak hedges, improves winter survival by protecting forage plants from temperature fluctuations during the winter.<sup>2</sup>
- Assess winter damage quickly in the spring to gauge the condition of the fields and take action as appropriate.<sup>7</sup>





## Climate Change

- Climate change will add its share of challenges to the winter survival of fields (especially alfalfa), since the intensity of the change varies from region to region.<sup>2,8</sup>
- Climate change may create opportunities in some regions by extending the growing season. Nevertheless, rising temperatures and greater hydric stress may become challenges for some regions and for certain species in particular.<sup>8</sup>
- While current management practices will continue to apply in the future, there are some strategies that can help improve the resilience of forage systems<sup>2</sup>:
  - ✓ Choose adapted species.
  - ✓ Choose adapted cultivars (e.g. dormancy level, resistance to disease).
  - ✓ Use forage mixtures and consider creating mixtures with multiples species (3 or more).
- Certain species will benefit more than others from climate change and higher temperatures.<sup>2</sup>
- Certain cultivars, such as those that are more dormant in the case of alfalfa, can survive better in the winter without affecting the total yield over the life span of the field.<sup>2</sup>
- Forage mixtures including species that complement each other in multiple ways are more resilient, because the species will not be affected in the same ways and as intensely by a disturbance, which can improve the stability of yields during the season and on a year-to-year basis.<sup>2</sup>

### References:

- <sup>1</sup> Agritel, 2006-2022; Landry et al., 2023 in Laroche, J.-P. January 10, 2023. Durable et rentable, de la prairie à l'étable! [Webinar]
- <sup>2</sup> Gilles Bélanger, Annie Claessens, Marie-Noëlle Thivierge and Gaëtan Tremblay (Editors). 2022. Guide de production - Plantes fourragères. 2<sup>nd</sup> edition. Volume 1. Centre de référence en agriculture et agroalimentaire du Québec. 273 p. ISBN 978-2-7649-0636-1. [www.craaq.qc.ca](http://www.craaq.qc.ca)
- <sup>3</sup> Piette, A. February 2021. Prairies : revenir aux bases. *Le producteur de lait québécois*. [On line]: <https://lait.org/fichiers/Revue/PLQ-2021-02/fourrages.pdf>
- <sup>4</sup> Le Bulletin des agriculteurs. June 9, 2023. Après les foins, c'est le moment de fertiliser. [On line]: <https://www.lebulletin.com/cultures/experts-fourrages/foin-fertiliser-127500>
- <sup>5</sup> Normandin, C. July 24, 2014. L'épandage de fumier sur les nouvelles prairies : gare aux dommages! [On line]: <https://www.lebulletin.com/autres/lepandage-de-fumier-sur-les-nouvelles-prairies-gare-aux-dommages-66514>
- <sup>6</sup> Thivierge, M.-N., Bélanger, G., Jégo, G., Delmotte, S., and Charbonneau, É. 2023. Vers des systèmes fourragers résilients et adaptés aux changements climatiques. Journée à foins : de la théorie à la pratique, Conseil québécois des plantes fourragères (CQPF), Coaticook, QC, September 19, 2023.
- <sup>7</sup> Martel, H., N. Hallé et J.-P. Laroche. 2022. "Des solutions pour lutter contre les changements climatiques et leurs répercussions en production fourragère." [On line]: [https://lactanet.ca/wp-content/uploads/2023/01/Martel-Halle-Laroche\\_2022\\_Arbre-decisionnel-CC.pdf](https://lactanet.ca/wp-content/uploads/2023/01/Martel-Halle-Laroche_2022_Arbre-decisionnel-CC.pdf)
- <sup>8</sup> CDAQ. 2020. "Fiches de sensibilisation aux changements climatiques." [On line]: <https://agriclimat.ca/les-regions/>

# Useful Resources



Please click on the hyperlinks to access each resource\*.

- **Webinar** introducing the “Sustainable and Profitable, from Field to Barn” training course
- **Forage crop production Guide** – Plantes fourragères 2<sup>nd</sup> Edition, Volume 1 published by the Centre de référence en agriculture et agroalimentaire du Québec (CRAAQ, 2022)
- **Video** about seeding quality forage plants entitled “Un semis de plantes fourragères de qualité,” which was produced by the Coordination services-conseils in collaboration with the Ministère de l’Agriculture, des Pêcheries et de l’Alimentation du Québec (MAPAQ) and the Centre de référence en agriculture et agroalimentaire du Québec through MAPAQ’s agricultural advisory service support program.
- **Video clips** on climate change by region entitled “Évolution du climat par région” (CDAQ, 2023), which can be watched on the YouTube channel of the Conseil pour le développement de l’agriculture du Québec (CDAQ).
- **Training activity** discussing solutions for the fight against climate change and its impact on forage production entitled “Des solutions pour lutter contre les changements climatiques et leurs répercussions en production fourragère,” which was developed by Lactanet, the CDAQ and MAPAQ in 2022 and is available on the CIBLE d’AGRIcarrières Platform.
- **Decision tree** for evaluating fields in the spring that was taken from the training activity entitled “Des solutions pour lutter contre les changements climatiques et leurs répercussions en production fourragère,” a project funded through the fight against climate change in agriculture program, under the 2013-2020 Climate Change Action Plan.
- **10 technical sheets** on alfalfa fields developed by the Coordination services-conseils et ses partenaires (Mon Système Fourragère, the Conseil québécois des plantes fourragères and Les Producteurs de lait du Québec) as part of the Innov’Action program.

\* Note: all these resources are in French.

# Quality Training

## What forage DMI can be obtained with good forage?

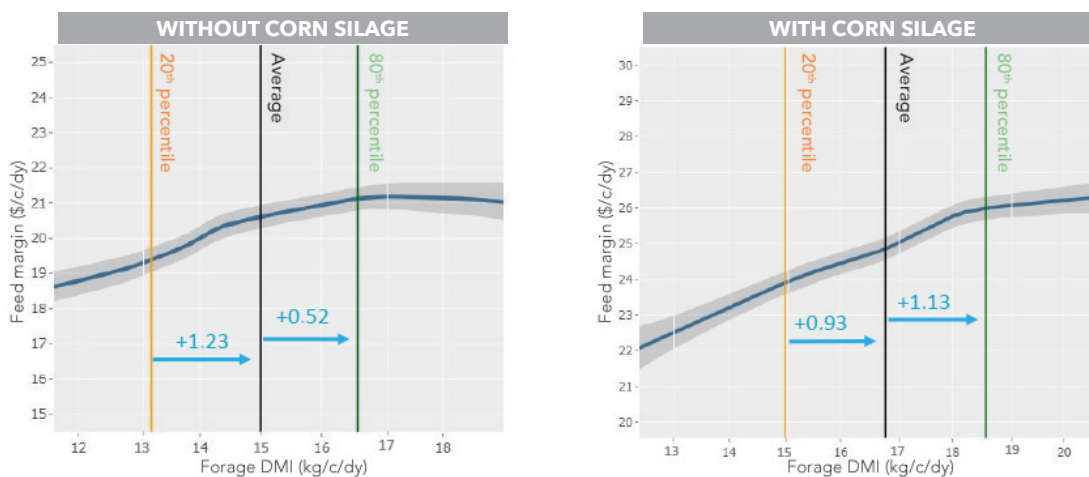
	WITHOUT CORN SILAGE	WITH CORN SILAGE
Holstein (724 kg)	≈ 16 and +	≈ 17 - 18 and +
Ayrshire	≈ 15 and +	≈ 15 - 17 and +
Jersey	≈ 13 and +	≈ 13 - 14 and +

### Your result is affected by:

- the average weight of your cows
- the quality and type of forage
- the length of particles
- feeding management
- other factors

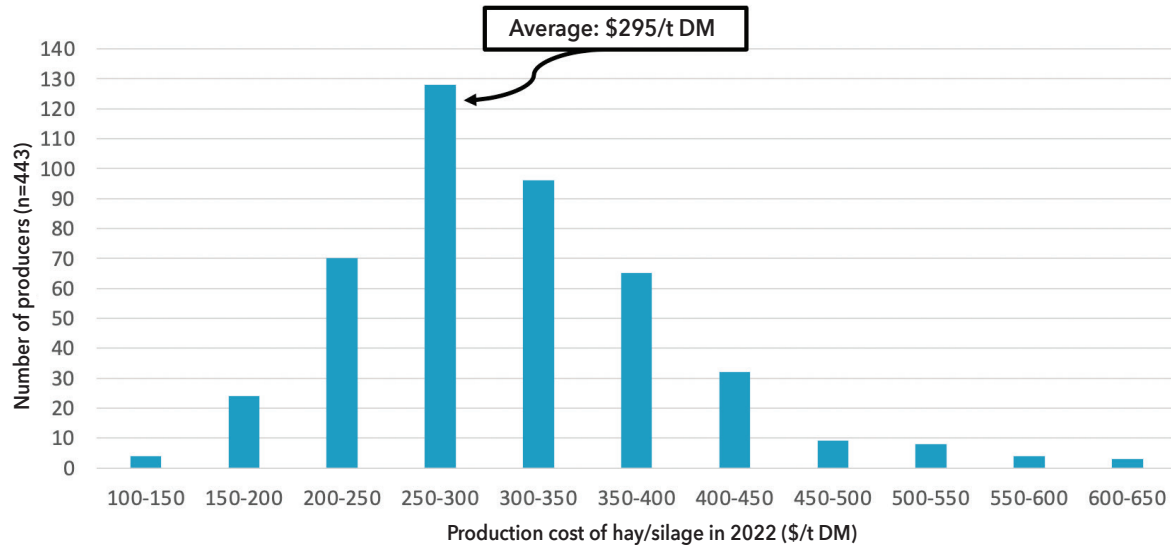
## Where do you fall?

### Data from 2023 and price of milk in August 2023



Clearly, there are other important factors that affect the margin...

## Do you know how much it costs to produce your forage?



The margins per cow are calculated based on the standard cost of forage, but the reality may be very different...

Source: Agritel, 2022

## How do you optimize forage DMI?

- By improving forage quality
  - maturity
  - soil contamination
  - sugar level
  - protein level
  - conservation
- By providing the right forage to the right animals
- By improving feeder management



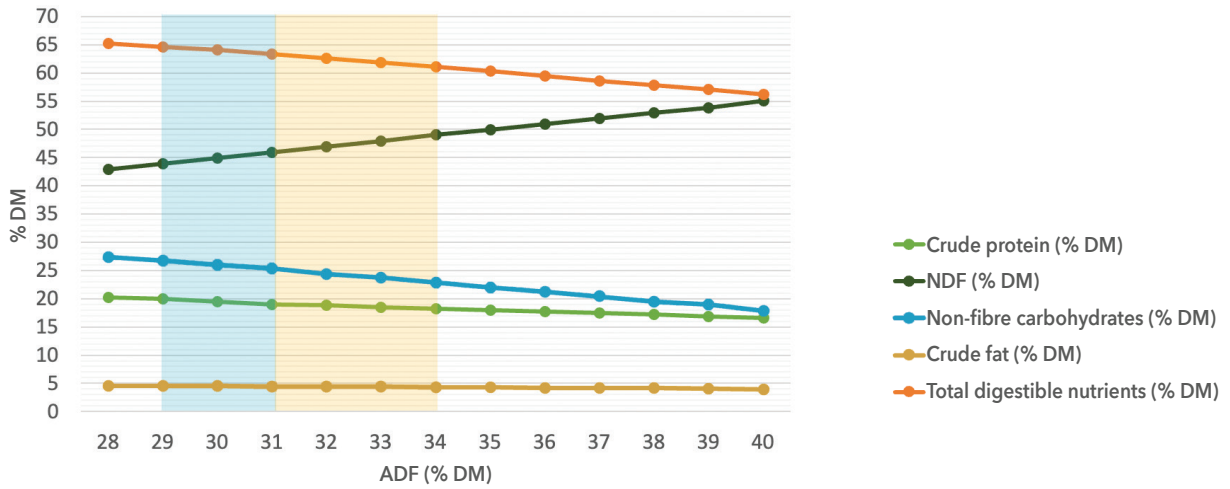
## Objectives during the Harvest

Parameter	Result and Unit	Parameter	Result and Unit
DRY MATTER		uNDFom 120	
Dry matter	>30-32% DM (adapt to the type of storage)	uNDFom 240	
<b>PROTEIN</b>		<b>CARBOHYDRATES AND FATS</b>	
Crude Protein (CP)		NFC	
NDP % CP		Water-soluble sugars	
% soluble CP		Ethanol-soluble sugars	
N-NH3 (% CP)		Starch	
ADF-CP		Fat	
NDF-CP		Total Fatty Acids (TFA)	
<b>ENERGY AND CALCULATIONS</b>		Unsaturated fatty acids in the rumen (UFAR)	
TDN 1x (NRC 2001)		C18:1 Oleic	
NEL		C18:2 Linoleic	
NEM		C18:3 Linolenic	
NEG		<b>MINERALS</b>	
ME sheep		Total calcium (Ca)	
DE horse		Total phosphorus (P)	
		Total magnesium (Mg)	
Forage Value Index (FVI)		Total potassium (K)	
<b>FIBRES</b>		Sulfur (S)	>0.25% DM (70% and + alfalfa)
Acid Detergent Fibre (ADF)	≈ 30% DM	Ash	<10% DM
Neutral Detergent Fibre (NDF)		<b>FERMENTATION PROFILE</b>	
aNDFom		Estimated total acids	
Lignin		Lactic acid	
NDFD 30 (% NDF)		Lactic acid/total acids ratio	
NDFD 48 (% NDF)		Acetic acid	
NDFDom 30 (% NDF)		Butyric acid	
NDFDom 120 (% NDF)		pH	
NDFDom 240 (% NDF)			



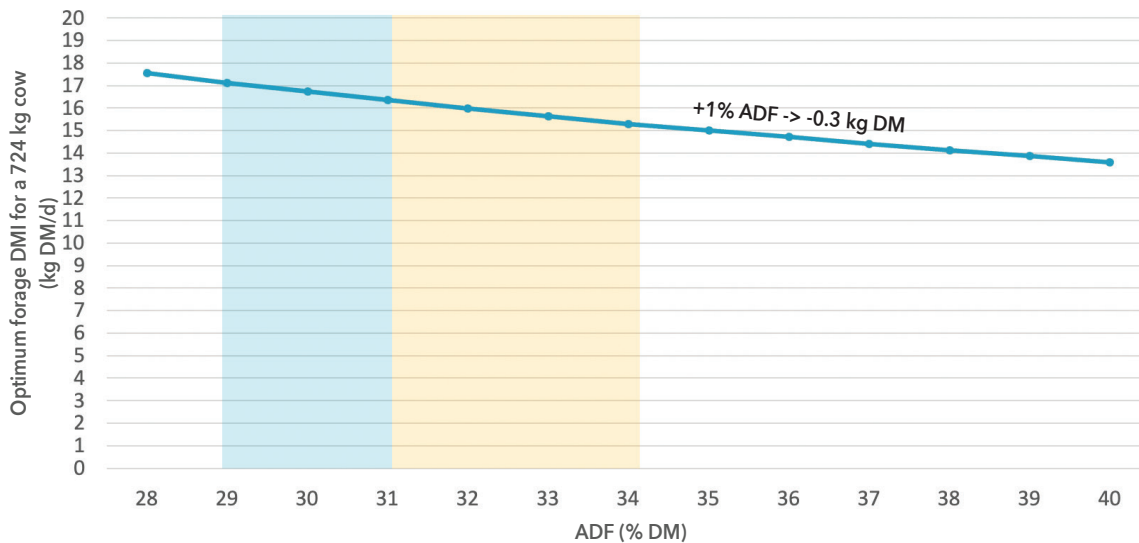
# Maturity

## Nutritional value decreases with maturity



50% legume-based mixed fermented silages (n = 18,527)

## Forage intake potential decreases with maturity

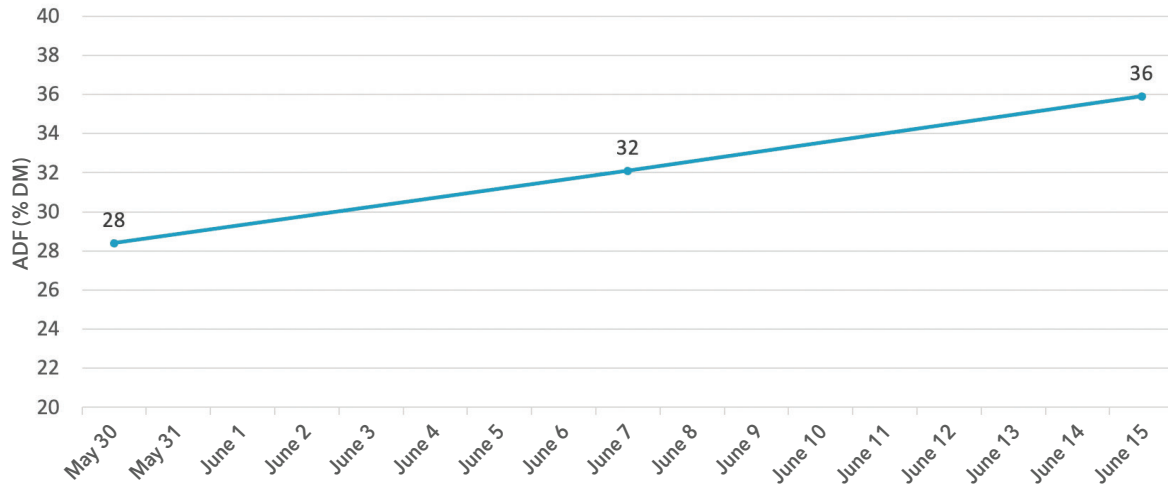


50% legume-based mixed fermented silages (n=18,527)



# Time is money!

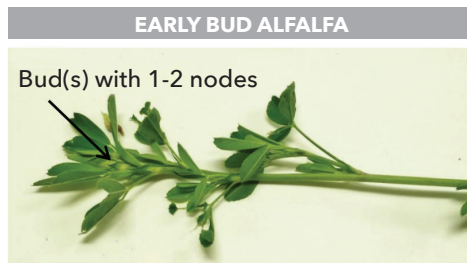
**Changes in the ADF of timothy over time (Norway)**



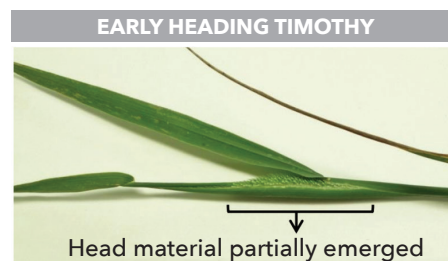
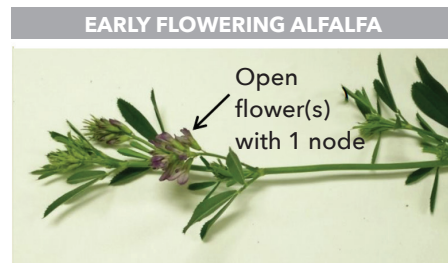
**In our conditions for the first cut**  
 Grass: +0.5 to 0.7% ADF per day  
 Alfalfa: +0.3 to 0.5% ADF per day

Source: Randby et al., 2012

## QUALITY MANAGEMENT

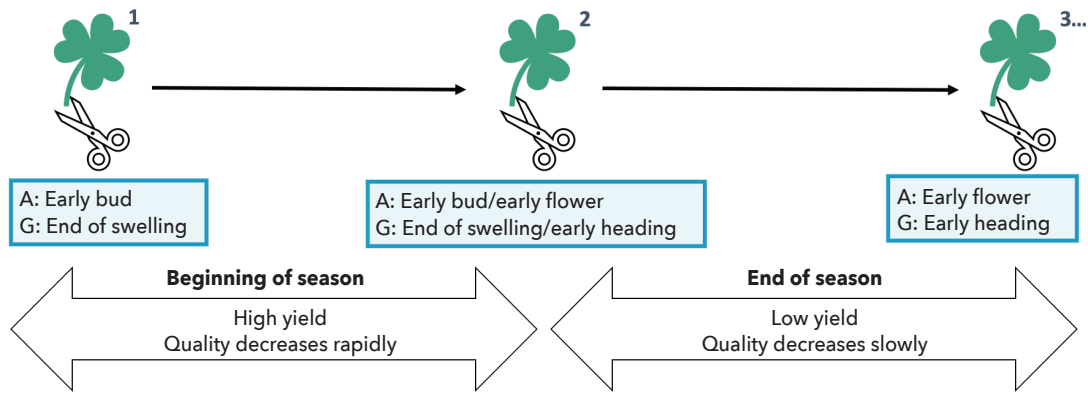


## YIELD AND PERSISTENCE MANAGEMENT



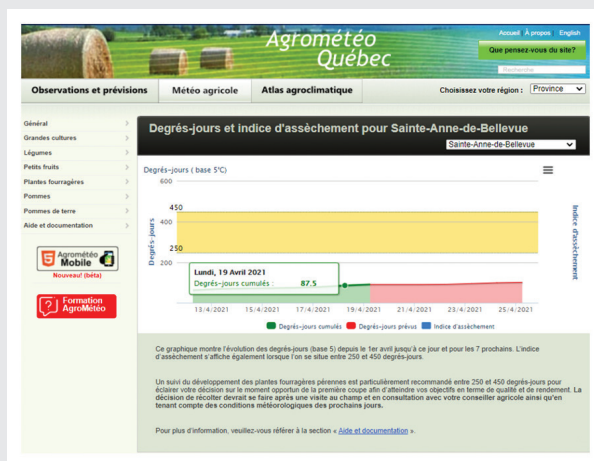
Source: Pomerleau-Lacasse et al., 2017, Ministry of Agriculture and Agri-Food, Government of Canada

## “Fast and Slow” Technique



- With this strategy, you have a good yield, good persistence, and good quality
- The distribution of forage quality meets the various needs of the herd fairly well

## Tools to help you



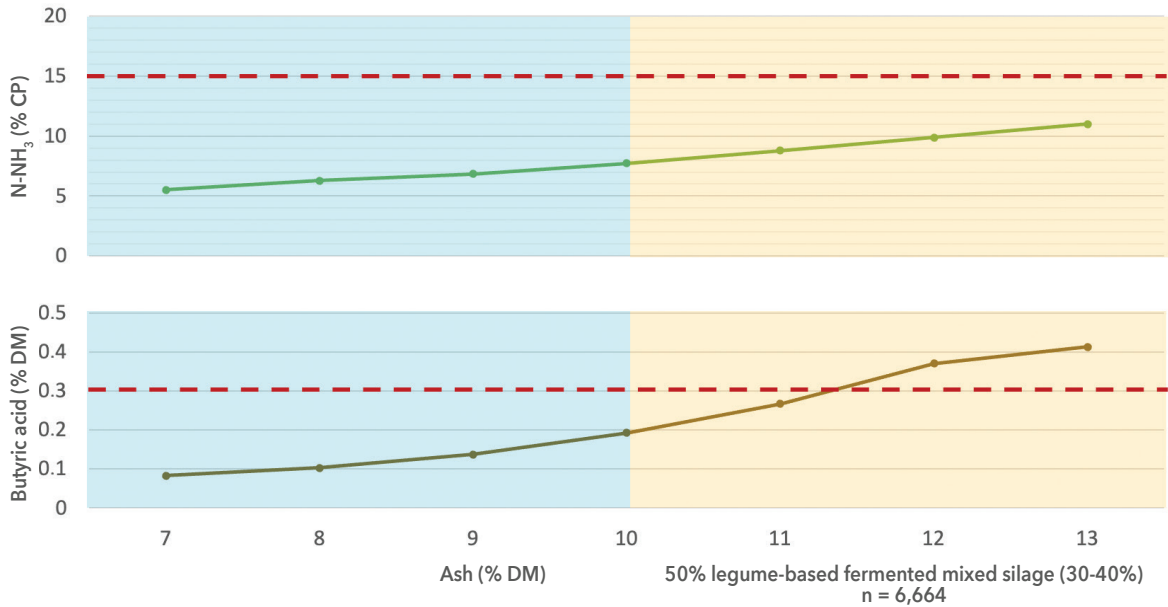
Degree days: Find out when to walk the fields



Guidance on determining the best time for the harvest

# Soil Contamination

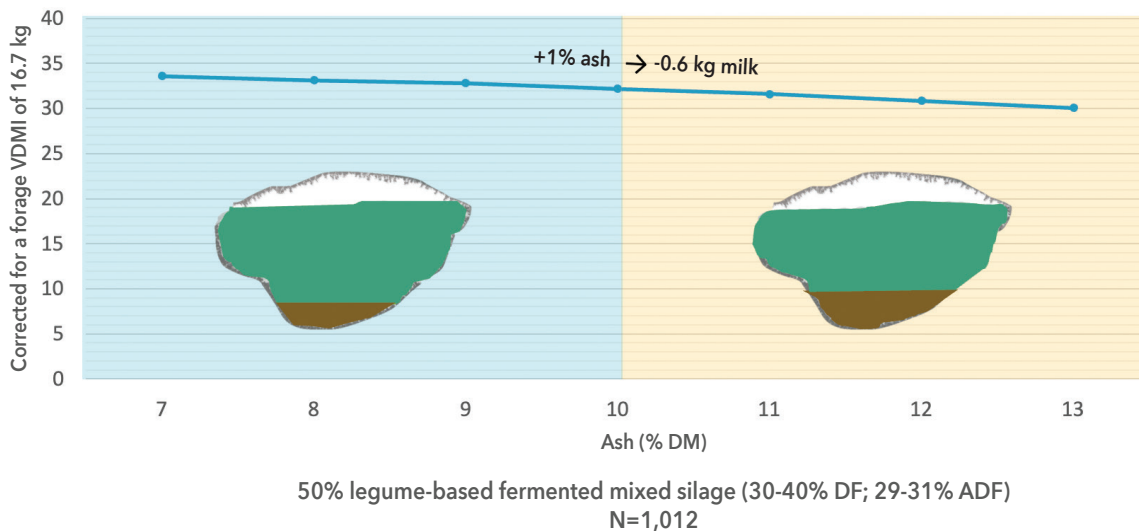
## Ash = inoculant for bad bacteria



### Average ash content level:

- Grass ≈ 6%
- Legumes ≈ 8%

## Soil takes up space



## Basics: Cut at 10 cm (4 in)

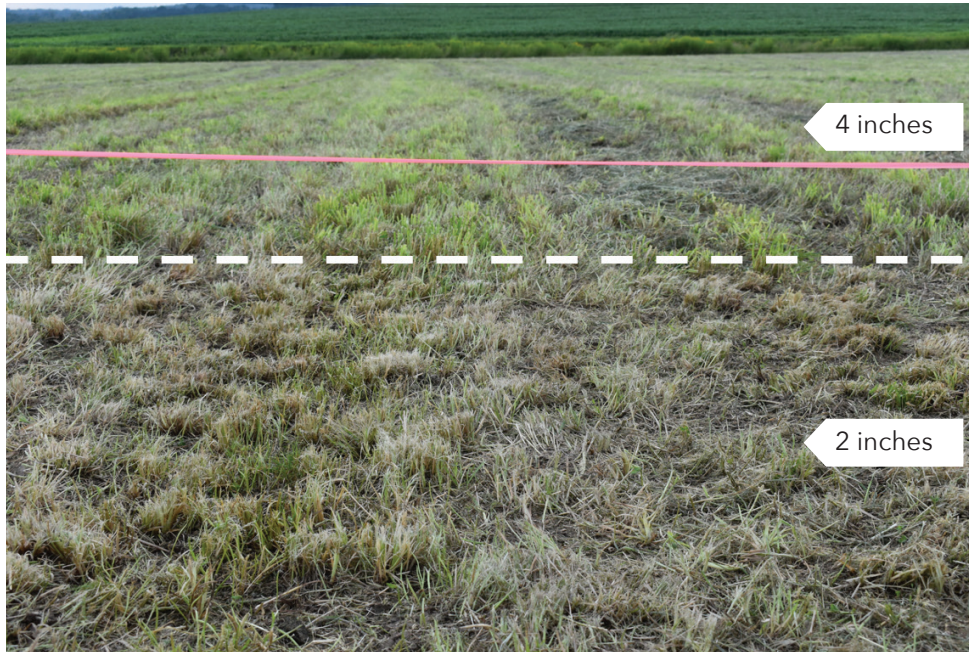


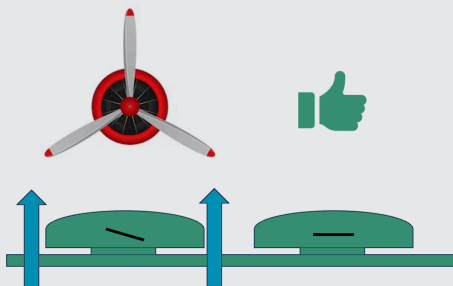
Photo by Marie-Pier Landry,  
C.I.A.R.C., 2023



If it is yellow or brown after cutting, there is a good chance that it was too close to the ground!

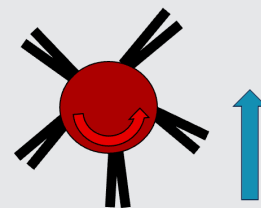
## Avoid suction effects

### Disc mower



Angled blades are good for picking up the forage that has fallen, but also for picking up soil! Flat blades are better.

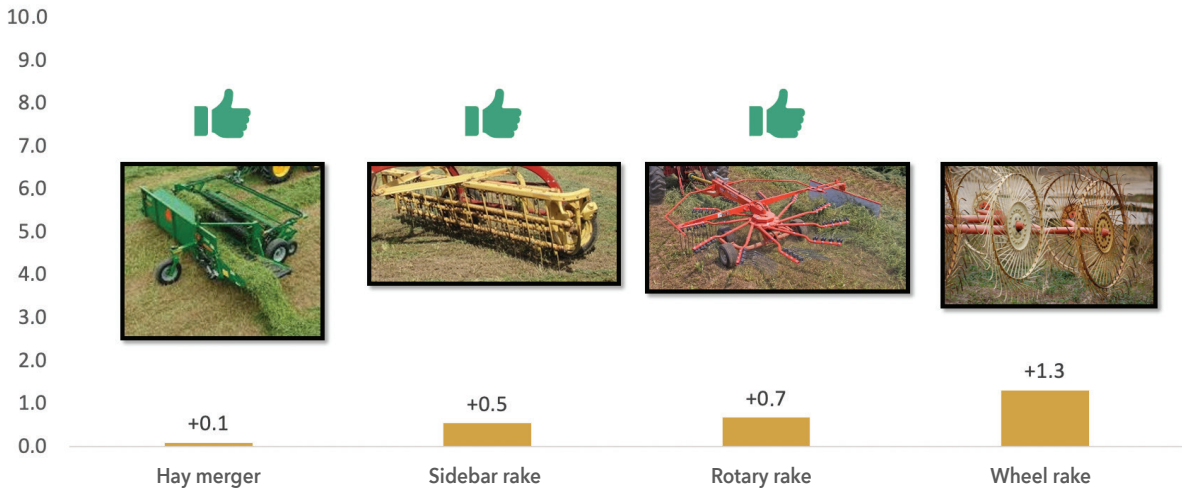
### Flail conditioners



Flail conditioners are useful for grass hay, but also have a suction effect.

## What types of rakes are best?

### Increase in % of ash in the forage

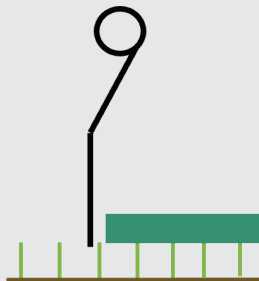


No effect on CP content (leaf loss) in the study on types of rakes

Source: Adapted by Neu et al., 2017

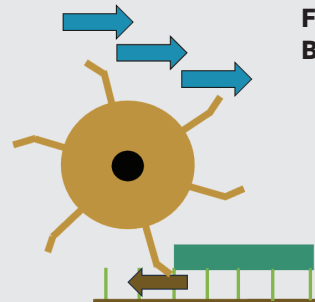
## Equipment adjustments

### Rakes



The teeth of the rake must be adjusted for the top of the stubble ... unless your goal is to level the soil!

### Forage harvester/ Baler/Hay merger



The equipment that picks up the forage must not go too fast, otherwise the forage will rub against the ground before entering the machine.



# Sugar Level

Why do you want more sugar?



Fuel for good bacteria while silage ferments



Low acid-forming source of energy for microbes in the rumen

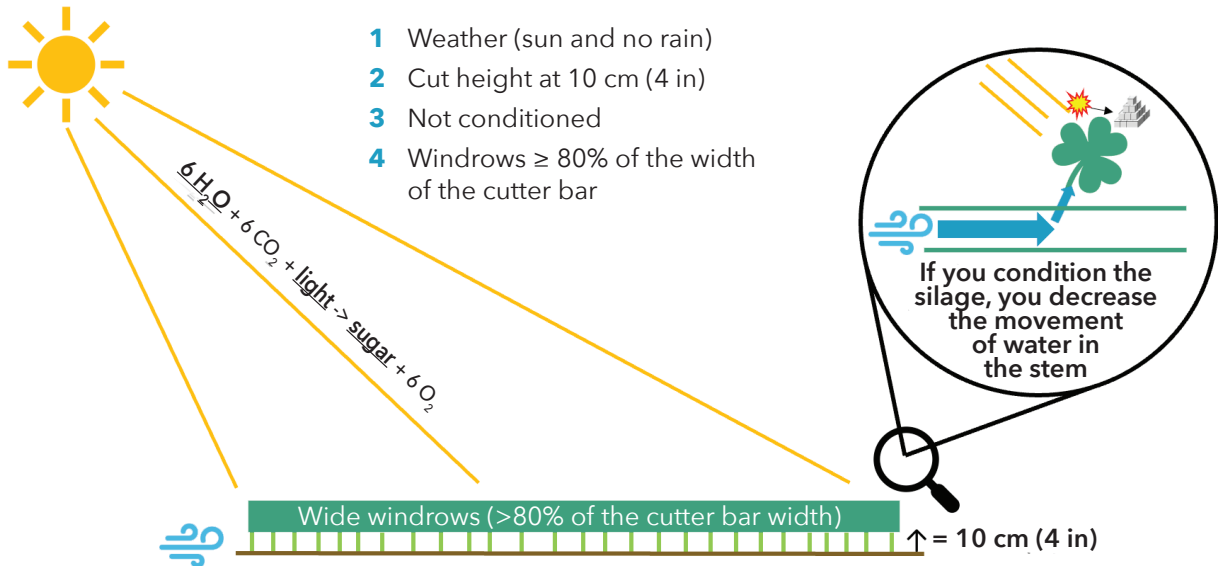


Positive effect on the fat test

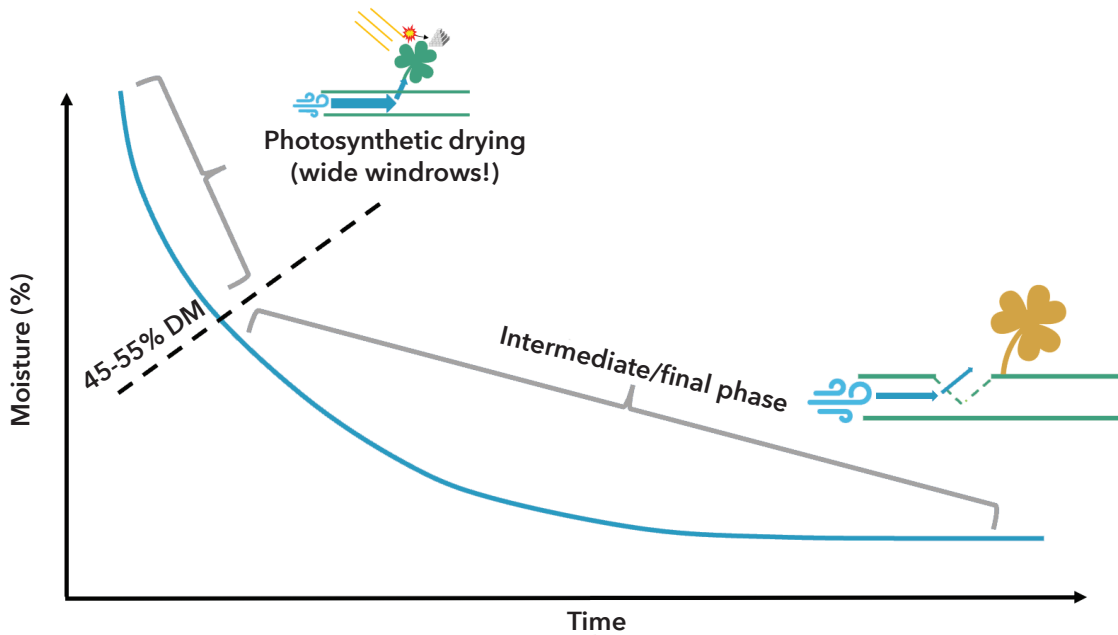


Encourages forage consumption by cows

## Silage with high sugar content



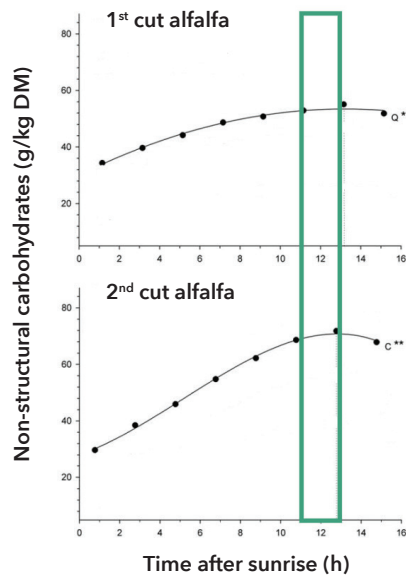
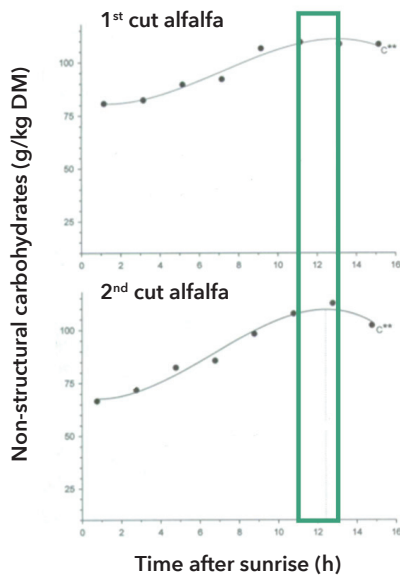
## Should you buy a mower-conditioner?



### Conclusion?

- Wide windrow silage → no conditioner
- Wide windrow haylage → grey zone...
- Hay → conditioner

## Forage contains more sugar in the afternoon

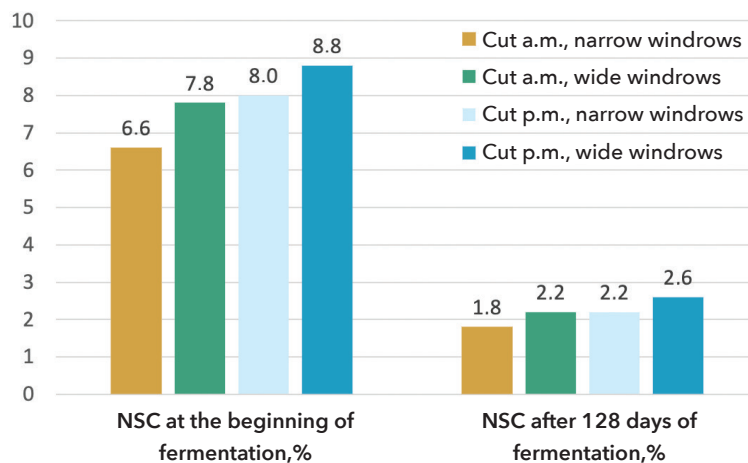


Maximum level achieved 11-13 h after sunrise (4 p.m. to 6 p.m.)

Sources: Morin et al., 2011; Morin et al., 2012

## What do you gain when you do all that?

### Effect of harvest management on the sugar content in a second alfalfa cut (DM ≈ 35%)



Here are the compiled results of several Quebec studies...  
 Wide windrows → + ≈1% NSC  
 Cut between 4 & 6 p.m. → + ≈ 1-2% NSC  
 A 1% difference is enough to see an effect on silage quality, DMI and cow productivity...

Source: Tremblay et al., 2014

# Protein Level

## Basics: legume percentage

### Impact of legume percentage with an ADF of 30%

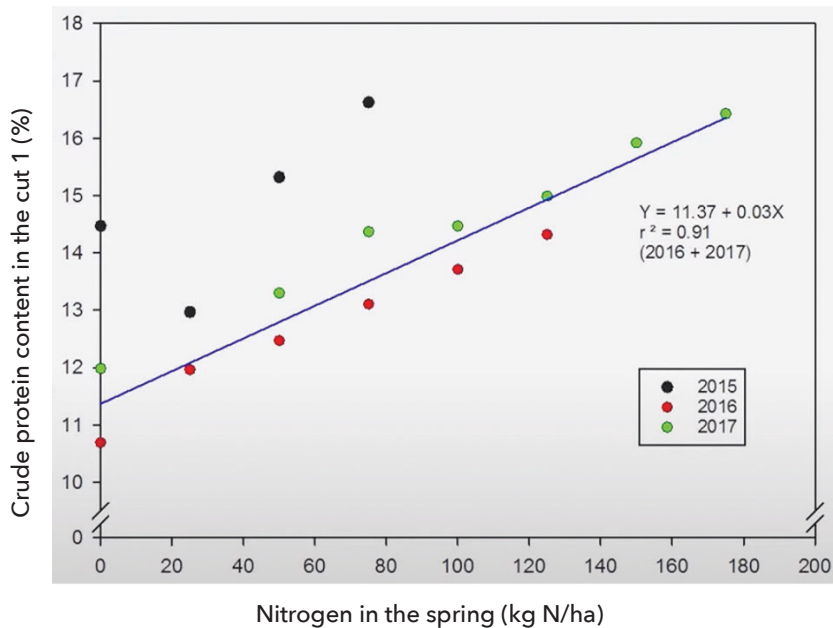
	70% GRASS	≈50% LEGUMES	70% LEGUMES
Crude Protein (% DM)	17.9	19.4	20.6
ADF (% DM)	30.0	30.0	30.0
NDF (% DM)	49.0	45.0	41.6
NDFd 30-h (% NDF)	68.6	65.2	61.6
NEL (Mcal/kg DM)	1.45	1.45	1.44



What do you need in the ration?

## Grass fertilization in the spring

### Crude protein in hay (cut 1)



For the first cut, every 50 units of nitrogen increase CP by about 1%.  
Consult your agro consultant!

Source: Parent et al., 2018

## Alfalfa fertilization with sulfur



Photo: Julie Lajeunesse, Agr., M. Sc. - Agriculture and Agri-Food Canada



Does your alfalfa seem like it has a deficiency? Consult your agro consultant!

- Alfalfa needs a lot of sulfur
- When alfalfa shows signs of a deficiency, sulfur fertilizer is the answer:
  - **↑ CP of 1 to 4 percentage units**
  - **↑ yield 1 to 4 t DM/ha**

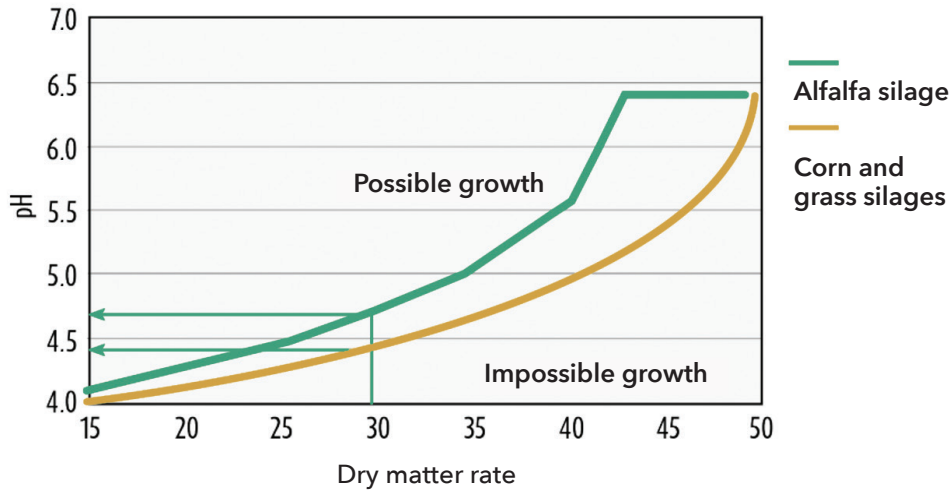


# Conservation

## Conservation Objectives

Parameter	Result and Unit	Parameter	Result and Unit
<b>DRY MATTER</b>		uNDFom 120	
Dry matter	>30% DM (adapt to the type of storage)	uNDFom 240	
<b>PROTEIN</b>		<b>CARBOHYDRATES AND FATS</b>	
Crude Protein (CP)		NFC	
NDP % CP		Water-soluble sugars	
% soluble CP		Ethanol-soluble sugars	
N-NH3 (% CP)	<15% CP	Starch	
ADF-CP	<10% CP	Fat	
NDF-CP		Total Fatty Acids (TFA)	
<b>ENERGY AND CALCULATIONS</b>		Unsaturated fatty acids in the rumen (UFAR)	
TDN 1x (NRC 2001)		C18:1 Oleic	
NEL		C18:2 Linoleic	
NEM		C18:3 Linolenic	
NEG	NEG	<b>MINERALS</b>	
ME sheep		Total calcium (Ca)	
DE horse		Total phosphorus (P)	
		Total magnesium (Mg)	
Forage value index (FVI)		Total potassium (K)	
<b>FIBRES</b>		Sulfur (S)	>0.25% DM (alfalfa only)
Acide Detergent Fibre (ADF) ≈ 30% DM		Ash	<10% DM
Neutral Detergent Fibre (NDF)		<b>FERMENTATION PROFILE</b>	
aNDFom		Estimated total acids	
Lignin		Lactic acid	
NDFD 30 (% NDF)		Lactic acid/total acids ratio	>65%
NDFD 48 (% NDF)		Acetic acid	<3% DM
NDFDom 30 (% NDF)		Butyric acid	<0.3% DM
NDFDom 120 (% NDF)		Ph	Depends on the DM level
NDFDom 240 (% NDF)			

## pH stability



Adapted by Muck et al., 2003



## Are you listening to

what your forage analysis is telling you?

Checklist for evaluating a grass silage analysis intended for highly productive cows



# The Right Forage for the Right Animals

## Groups of animals to feed and their needs

TYPE OF ANIMAL	AVERAGE FORAGE CONSUMPTION (T DM/ANIMAL/YR)	FORAGE DMI DURING LACTATION (KG DM/D)
Cow (≈8,000 kg milk/year)	5.1	14.4
Cow (≈10,200 kg milk/year)	5.7	16.3
Cow (≈12,000 kg milk/year)	6.0	17.3
Replacement animal	3.0	-

\*Source: Lactanet database

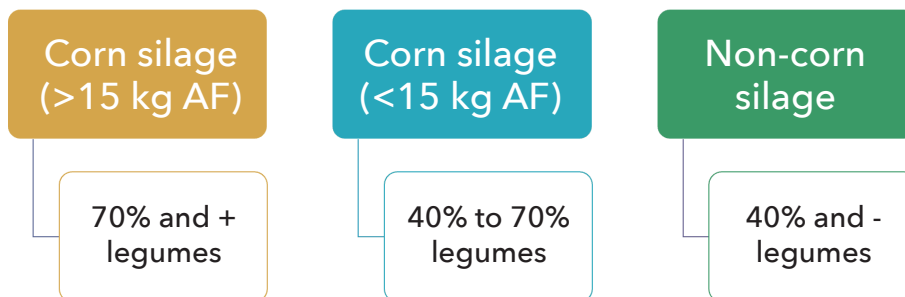
- Per animal group?
- Types of forages?
- Discuss it with your consultant!

## The right forage for the right group

	LACTATING COWS	DRY COWS	TRANSITION COWS	REPLACEMENT ANIMALS
ADF	30	≈35	≈35	≈35
Protein	Depends on the rest of the ration			
Potassium (K)	-	-	To be monitored	-

- For forage that is low in potassium, prioritize a timothy-based mixture grown in a low-potassium field (<150 kg/ha). Avoid orchard grass.

## Complementary forages



# Feeder Management

- Optimized forage quality in rations
- Particle length → Penn State
- Fresh feed → Remove refusals in the mornings
- Access to feed at all times → 3%-5% refusals
- Stimulate animals → Push or serve rations frequently
- Brightness → 200 lux
- Monitorate DM
- Quality water availability







# SUSTAINABLE AND PROFITABLE

From Field to Barn

WITH ASSISTANCE FROM



With the financial support of

